8. PASSAGE AND OCCUPANCY TIMES

Events Occurring in a Duration

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The paper considers the distribution of the number of occurrences of an event in a time duration of variable length in terms of the probability distributions of the length of duration and of the rate of occurrence in a unit time. Four cases are considered according to whether the two distributions (of duration and rate) are discrete or continuous. Applications to queuing and inventory theory are pointed out.

Occupancy Probability and its Applications

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Several works have dealt with Occupancy Problems such as cases without any restriction on the capacities of the cells, cases for restricted capacities of the cells, limiting distributions and their applications in probability theory.

There are three important theories of Statistical Physics viz. Maxwell–Boltzman Statistics, Bose–Einstein Statistics and Fermi–Dirac Statistics related to the Occupancy Problem. Brillouin has suggested a generalised statistic which includes these three statistics.

The Occupancy problem has also been studied with the help of Markov chains. The purpose of this paper is to discuss some of these results, their limiting distributions, their applications and to derive some results.

On First Passage Time Structure of Birth–Death Chains in Discrete Time

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For continuous time birth–death processes on $(0, 1, 2, \ldots)$, the first passage time T_n^+ from n to $n+1$ is always a mixture of $(n+1)$ independent exponential random variables. Furthermore, the first passage time $T_{0,n+1}$ from 0 to $(n+1)$ is always a sum of $(n+1)$ independent exponential random variables. The discrete time analogue, however, does not necessarily hold in spite of structural similarities. In this paper, some necessary and sufficient conditions are established under which T_n^+ and $T_{0,n+1}$ for discrete time birth-death chains become a mixture and a sum, respectively, of $(n+1)$ independent geometric random variables on $(1, 2, \ldots)$. The results are further extended to conditional first passage times.